

Hand Hygiene: Hand Washing vs. Hand Sanitizer for Killing the Germs

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Abstract

This study was conducted to compare handwashing using soap and hand sanitizer to kill germs on hands. Hand washing is one of the preventive measures to avoid various diseases that can be transmitted through hands. In addition, the COVID-19 pandemic which has attacked almost all over the world has forced various levels of society to pay more attention to hygiene, especially hand hygiene which can be a bridge for the spread of the virus. The research conducted in this article uses qualitative research methods based on reviews and analysis from several journals related to the comparison of the effectiveness of handwashing using soap and hand sanitizer. The results showed that there was a difference in the number of microorganisms in the hands before and after washing hands. Soap and hand sanitizer can eliminate microorganisms because both of these ingredients contain ingredients that can reduce the number of harmful bacteria in the hands such as alcohol and triclosan. From the analysis of several journals related to the effectiveness of handwashing using soap and hand sanitizer can be concluded that hand washing using soap and water is considered more effective to eliminate microorganisms on the hands than just the use of hand sanitizer.

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Introduction

According to WHO and the Chairman of the Indonesian Association of Infection Control Nurses, hands are one of the entrances of disease-causing germs into the body. Therefore, maintaining hand hygiene is one form of initial defense to maintain the health of the body. To reduce the rate of infection and transfer of microbes, the best and recommended strategy is to maintain hand hygiene by washing hands. WHO data shows that hands contain bacteria that amount to 39,000–460,000 CFU/cm² which has a high potential to cause infectious diseases and contributes to 3.5% of total deaths in Indonesia (Sari and Isadiartuti, 2006).

The pandemic coronavirus infectious disease (COVID-19) is a spreading virus that is affecting almost all over the world. The disease is caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The COVID-19 outbreak was first detected in Wuhan City, Hubei Province, China in December 2019. WHO has been reported more than 2 million cases of COVID-19 in more than 210 countries from March 2020 to April 2020 (Nakoe et al., 2020). The Committee for Handling of COVID-19 and National Economic

Recovery reported that the positive cases of COVID-19 in Indonesia had reached 1,668,368 people as of April 30, 2021.

SARS-CoV-2 is estimated to be spread through respiratory droplets when the person coughs or sneezes so that it spreads among the people around him. It can also be from the surface of an object that has been contaminated which then accidentally touches someone's face and infects the respiratory tract. Some of the recommended preventive measures to avoid the spread of SARS-CoV-2, for example: wear a mask, keep distance from others or social distance, wash hands with soap, stay away from crowds, and limit mobility and interaction.

The dynamics of modern society cause humans to always move faster and more efficiently (Wahyono et al., 2006). There are many innovative products, especially during this pandemic, one of which is widely used by the community is a cleanser in the form of an antiseptic liquid or gel commonly called a hand sanitizer that can be used anywhere and anytime without having to rinse with water. This hand sanitizer product contains antiseptics that can be used to kill germs on hands. It is composed of several ingredients such as 62% ethyl alcohol and triclosan. The types of hand sanitizer products are increasingly diverse in terms of composition and carrier substances. These various hand sanitizer products have been widely used by the community (Radji et al., 2007).

Based on previous studies on the comparison of the effectiveness of hand sanitizer compared to washing hands with soap, there are significant differences between the effectiveness of using hand sanitizer and liquid antiseptic soap in reducing the number of bacterial colonies on the hands. Washing hands with soap is considered more effective in reducing the number of bacterial colonies on hands and washing hands with soap is still the main choice in maintaining hand hygiene (Akim, 2013). Based on this background, a study was conducted to compare the effectivity of handwashing with soap and hand sanitizer in killing germs on hands.

Methods

The research method used in this article is qualitative research or library research based on reviews and analyzes from several journals related to the effectiveness of handwashing using soap and hand sanitizer. Library research (literature studies) is one type of literature research that uses the necessary data and materials in completing research derived from books, encyclopedias, dictionaries, journals, documents, magazines, and other scientific sources (Harahap, 2020).

The analysis of the articles in this review was carried out in three stages. First, collecting data from several journals. Second, identifying problems from each journal related to the comparison of handwashing with soap and hand sanitizer. Third, analyzing and concluding the results from the review of several journals.

Results and Discussion

In handwashing, the level of efficacy of removing bacteria between only using water with combination water and soap is different. Washing hands with soap is more effective than washing hands with water alone. Soap can kill many bacteria because there are special components that control bacteria on the hands. Soap is divided into two types, called ordinary soap and antiseptic soap.

Antiseptic soap was control bacteria on the hands. That contains antibacterial substances (triclosan). This material can reduce the number of harmful bacteria on hands for a long time, while ordinary soap can remove bacteria for a short time (Cordita, 2019). Several other active ingredients in hand soap consist of alcohol, emollient, triclocarban, triclosan, and others (Nakoe, 2020). Figure 1 and 2 explains the effect of triclosan in soap for Gram-Positive and Gram-Negative bacterial inhibition (Kim et al., 2015).

Antibacterial is a substance that can interfere with the growth or even kill bacteria by interfering with the metabolism of harmful microbes. Antibacterial in soaps included in the antimicrobials used to inhibit the growth of bacteria. There are two types of soap known, that is solid soap and liquid soap. Liquid soap has advantages over solid soap, namely liquid soap is easy to use, more hygienic, easy to carry and not easily damaged or dirty. Liquid soap is more effective in removing dirt on the hand than solid soap or hand sanitizer. The antibacterial activity of liquid soap may be due to the secondary metabolites contained in aloe vera, namely saponins, flavonoids, terpenoids, tannins, and anthraquinone (Kumar et al., 2012).

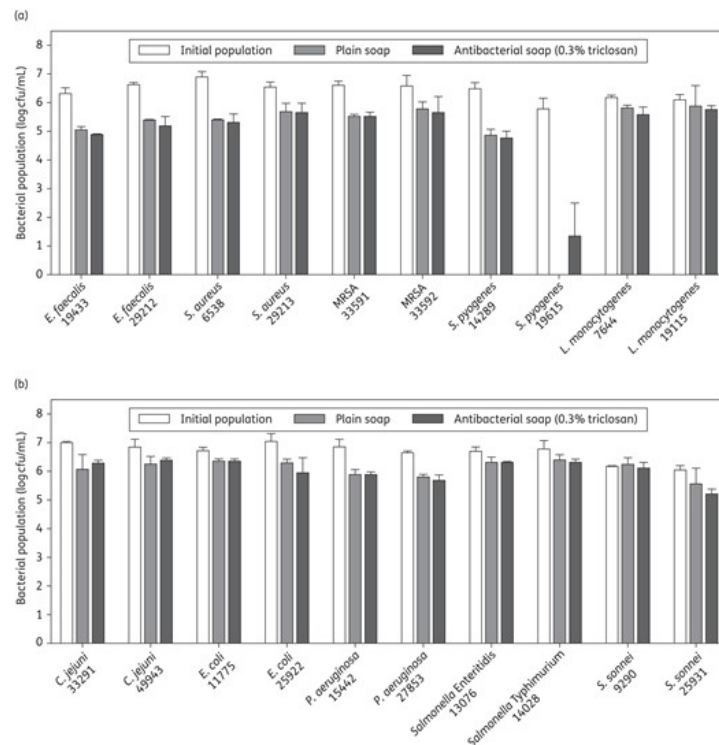


Figure 1. Bactericidal Effects of Plain and Antibacterial (0.3% triclosan) Soaps
(a) 10 strains of Gram-positive bacteria,
(b) 10 strains of Gram-negative bacteria when used at room temperature (22°C) for 20 s.

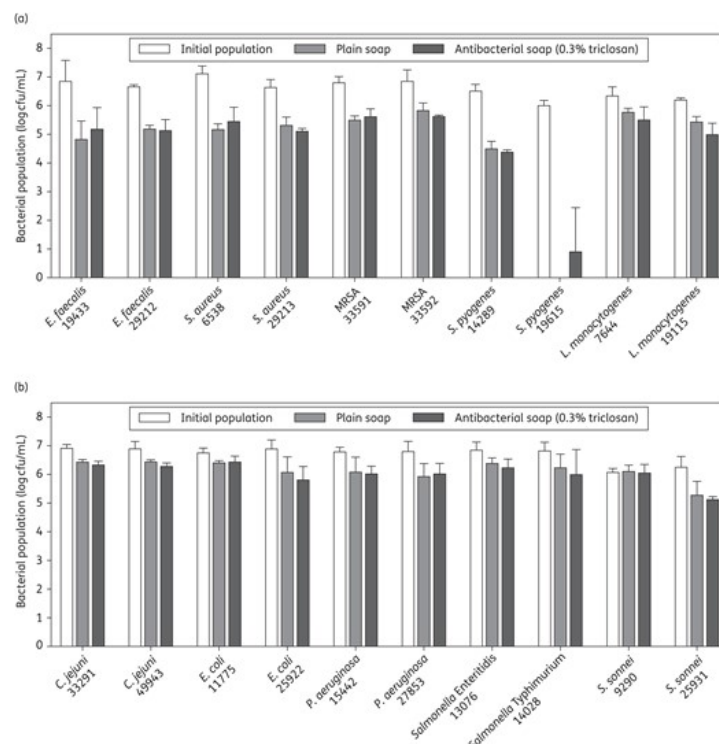


Figure 2. Bactericidal Effects of Plain and Antibacterial (0.3% triclosan) Soaps
(a) 10 strains of Gram-positive bacteria,
(b) 10 strains of Gram-negative bacteria when used at 40°C for 20s.

Saponins can damage the integrity of bacterial cell membranes (Xue *et al.*, 2017). Flavonoids can kill bacteria by lysing bacterial cell walls and reducing bacterial cell density (Dzoyem *et al.*, 2013). Terpenoids can dissolve bacterial cell walls by weakening membrane tissue (Hernandez *et al.*, 2000). Tannins inhibit bacterial cell wall synthesis by irreversible complex proteins (Mamtha *et al.*, 2004). Anthraquinone kills bacteria through the inhibition of protein synthesis and nucleic acid synthesis (Chang & But, 2001).

The soap contains antibacterial properties proved that soap inhibits or kills the growth of bacteria in the body. According to previous research, washing hands with soap can reduce bacteria on the hand by 50%-100% (Danuwirahadi, 2010). It proves that soap is very effective against antibacterial activity. Based on research by Cordite and Mayasari (2019), the effectiveness of reducing the number of germs when washing hands using hand sanitizer is 60%, and antiseptic soap is 73%. Thus, washing hands using antiseptic soap is more effective than washing hands according to the hand sanitizer.

Indication of time to wash hands is whenever our hands are dirty (after holding money, animals, gardening, etc.), after defecation, before eating, after sneezing, coughing, throwing snot, after coming home from traveling, and after playing. The procedure to washing hand according to Alvadri (2010), i.e. (1) Removing all objects attached to the hand area, such as rings or watches; (2) spreading soap with both palms; (3) Rubbing the back and between the sides, the fingers of the right hand and vice versa; (4) Rubbing the palms of the hand and between the fingers; (5) Cleansing the fingers on the inside of the two hands; (6) Rubbing the left thumb rotating in the grip of the right hand and vice versa; (7) Rubbing by turning the fingertips on the palm of the left hand and vice versa; (8) Cleaning (rinsing) the hands with running water until clean so that there is no soap liquid on the hand, with the ends of the hand facing down.

Along with the times, a gel-shaped product has developed that contains antiseptic as a hand sanitizer and does not need to rinse with water called hand sanitizer. Hand sanitizer consists of alcohol, gluconates, chloroxylenol, clofucarang, benzalkonium chloride, benzethonium chloride, chlorhexidine, hexachlorophene, hexylresorcinol, iodine, iodophors, and triclosan. Generally, hand sanitizer contains alcohol and triclosan (Nakoe, 2020). According to the Center for Disease Control (CDC), hand sanitizers are divided into two types, containing alcohol and nonalcoholic. Hand sanitizers with alcohol content between 60-90% have a better antimicrobial effect than those without alcohol. Hand sanitizer with active ingredient only alcohol has a limited residual influence compared to hand sanitizer containing a mixture of alcohol and antiseptics such as chlorhexidine.

Hand sanitizer is an efficient choice when away from the handwashing area, difficult to find a clean place, and go to travel (Srikartika *et al.*, 2016). Hand sanitizer is quite effective for killing germs and preventing the increase of microorganisms on the body surface (Desiyanto & Djannah, 2013). When using hand sanitizer, it must be ensured when pouring or spraying in sufficient quantities on both hands. That is because hand sanitizer too little and can not be effective in killing germs/bacteria. A sign of using hand sanitizer in sufficient quantities is when the hand sanitizer liquid can wet the entire area of the palms of the hands. According to Health Partners Riverway Clinic expert in Minnesota, dr. Zeke J McKinney said that it is better to use hand sanitizer in large quantities than too little.

Hand sanitizer works well when using correctly. Hand sanitizer uses applied for all parts of the hand. According to the Center for Disease Control (CDC), when using a hand sanitizer, you must rub your hands for at least 20 seconds until they are dry so that the hand sanitizer can work optimally. Avoid putting your hands on clothes or other places when it is still wet. It can allow germs to stick to the surface of the hands again (Fatmawati, 2020).

The hand sanitizer has the active ingredient of 40 - 80% alcohol. The difference in the number of germs before and after using hand sanitizer occurs because of alcohol activity. Alcohol acts as an antimicrobial by denaturing the bacterial protein. It interferes with the metabolic processes of bacterial cells, which cause bacterial cell death.

The use of hand sanitizer in bottles usually does not run out immediately but is used repeatedly. It can affect the quality of hand sanitizer in killing germs. Alcohol is a volatile active ingredient. Evaporation is affected by temperature and surface area. An increase in temperature will cause an increase in the movement of molecules from the liquid phase to the gas phase (evaporation). A wider surface provides a bigger opportunity for molecules hand sanitizer to release (Soedjo, 1999).

Based on research by Cordita *et al.*, (2019) stated that washing hands using soap accompanied by water causes microorganisms to be released by mechanical or chemical friction when washing hands. Thus, it will be dispelled and no longer stick to the surface of the palms. Meanwhile, hand sanitizer also contains antibacterial substances is less effective than soap because washing hands does not use water. So that not all microorganisms are released and still attached to the surface of the palm. (Desiyanto & Djannah, 2013).

Hand sanitizer has less effectiveness against viruses than washing hands using soap. The sodium hypochlorite in soaps can destroy the integrity of the protein and RNA capsids from viruses. While hand sanitizer with alcohol only affects the protein capsids of the virus (Fukuzaki, 2006).

Washing hands using soap also considered being more effective because in addition to being able to remove microorganisms on hands. Soap can remove other attached dirt too. Dirt that sticks to the skin is generally oil, fat, and sweat. These substances are insoluble in water because of their non-polar nature. Soap dissolves dirt on the skin (Qisti & Rachmiati, 2009).

Conclusions and Recommendations

There is a difference in effectiveness between washing hands with soap and hand sanitizer. Washing hands with soap more effective than washing hands only using water. Washing hands with soap and running water more effectively remove microorganisms from hands compared to using hand sanitizers. Washing hands using water and soap causes microorganisms to be release by mechanical or chemical friction. Meanwhile, hand sanitizers that also contain antibacterial substances can't make all the microorganisms released and still stick to the surface of the palm. The effectivity of hand sanitizer to kill germs decreases with decreasing alcohol content that acts as an antimicrobial.

References

- Alvadri Z. (2010). *Hubungan pelaksanaan tindakan cuci tangan Perawat dengan Kejadian infeksi rumah sakit di rumah sakit sumber waras grogol*. Fakultas Ilmu Kesehatan Universitas Esa Unggul.
- Akim M. (2013) *Efektivitas hand sanitizer dibanding mencuci tangan memakai sabun dalam menjaga kebersihan tangan pada mahasiswa fakultas kedokteran universitas sumatera utara angkatan 2012* [skripsi]. Medan: Universitas Sumatera Utara.
- Chang, Hson-Mou., & But, Paul Pui-Hay. (2001). Pharmacology and Applications of Chinese Materia Medica. Volume I. *World Scientific Publishing*, Singapore. pp. 70-71.
- Cordita, Raka, N., Soleha, Tri, U., & Mayasari, D. (2019). Perbandingan Efektivitas Mencuci Tangan Menggunakan *Hand Sanitizer* dengan Sabun Antiseptik pada Tenaga Kesehatan di Ruang ICU RSUD Dr. H. Abdul Moeloek. *Agromedicine Unila*; 6(1): 149.
- Danuwirahadi. (2010). *Efektifitas Metode Expository Teaching Terhadap Perilaku Mencuci Tangan Dengan Menggunakan Sabun*. Skripsi. Universitas Katolik Soegijapranata Semarang.
- Desiyanto, F.A., & Djannah, S.N. (2013). Efektivitas Mencuci Tangan Menggunakan Cairan Pembersih Tangan Antiseptik (Hand Sanitizer) Terhadap Jumlah Angka Kuman. *Journal UAD Kesmas*. 7(2):75–82.
- Dzoyem, J.P., Hamamoto, H., Ngameni, B., Ngadjui, B.T., & Sekimizu, K. (2013). Antimicrobial action mechanism of flavonoids from *Dorstenia* species. *Drugs Discoveries & Therapeutics*, 7(2), 66-72.
- Fatmawati, F. (2020). Edukasi Penggunaan *Hand Sanitizer* dan Pembagian *Hand Sanitizer* disaat Pandemi Covid-19. *Journal of Character Education Societ*), 3(2), 432-438.
- Fukuzaki, S. (2006). Mechanisms of actions of sodium hypochlorite in cleaning and disinfection processes. *Biocontrol Sci*. 11:147-157.
- Harahap, N. (2020). *Penelitian Kualitatif*. Medan: Fakultas Dakwah dan Komunikasi IAIN-SU Medan.
- Hernandez, N.E., Tereschuk, M.L., & Abdala, L.R. (2000). Antimicrobial activity of flavonoids in medicinal plants from Tafi del valle. *Journal of Ethnopharmacology*, 73, 317-322.
- Kim, S. A., Moon, H., Lee, K., & Rhee, M. S. (2015). Bactericidal effects of triclosan in soap both in vitro and in vivo. *Journal of Antimicrobial Chemotherapy*, 70(12), 3345-3352.
- Kumar, H.N.K., Chandana, E., Preethi, S.D., & Chauhan, J.B. (2012). In vitro antimicrobial activity and phytochemical screening of *Aloe vera* Linn. *International Journal of Current Pharmaceutical Research*, 4(3), 45-47.
- Mamtha, B., Kavitha, K., Srinivasan, K.K., Shivananda, P.G. (2004). An in vitro study of the effect of *Cantella asiatica* (Indian pennywort) on enteric pathogens. *Indian Journal of Pharmacology*, 36(1), 41.

- Nakoe, M. R., Lalu, N. Y. S., & Amelia, Y. (2020). Perbedaan Efektivitas Hand-Sanitizer Dengan Cuci Tangan Menggunakan Sabun Sebagai Bentuk Pencegahan Covid-19. *Jambura Journal of health Sciences and Research*, 2(2): 65-70.
- Qisti & Rachmiati. (2009). *Sifat Kimia Sabun Transparan Dengan Penambahan Madu Pada Kosentrasi Yang Berbeda*. Skripsi. Bogor: IPB.
- Radji, M., Suryadi, H., & Ariyanti, D. (2007). Uji efektivitas antimikroba beberapa merek dagang pembersih tangan antiseptik. *Majalah Ilmu Kefarmasian*, 4(1): 1-6.
- Sari, R., & Isadiartuti, D. (2006). Studi Efektivitas Gel Sediaan Antiseptik Tangan Ekstrak Daun Sirih (*Piper betle* Linn.). *Majalah Farmasi Indonesia*, 17(4). 163-169.
- Soedoyo, P. (1999). *Fisika Dasar*. Yogyakarta: Andi.
- Srikartika, P., Suharti, N., & Anas, E. (2016). Kemampuan Daya Hambat Bahan Aktif Beberapa Merek Dagang *Hand sanitizer* terhadap Pertumbuhan *Staphylococcus aureus*. *Jurnal Kesehatan Andalas*, 5(3), 540–545.
- Wahyono, H., Duerimk, D., Farida, H., Negelkerke, N. J. D., Keuter, M., Lestari, E. S., & Van den Broek, P. J. (2006). Preventing Nosocomial Infection: Improving Compliance With Standard Precautions in An Indonesian Teaching Hospital. *Journal of Hospital Infection*, 64(1): 36-4.
- Xue, P., Yao, Y., Yang, X.S., Feng, J., & Ren, G.X. (2017). Improved antimicrobial effect of ginseng extract by heat transformation. *Journal of Ginseng Research*, 41, 180- 187.